REMARKS -- TABLE OF CONTENTS

I. STATUS OF CLAIMS

Claims 1-45 were pending for examination at the time of the office action.

Claims 21-40 stand rejected under 35 USC §101 as directing the claims to non-statutory subject matter. See Office Action, p. 13 (27 May, 2008).

Claims 21-40 stand rejected under 35 USC §112, first paragraph, as failing to comply with the enablement requirement. See Office Action, p. 14-15 (27 May, 2008).

Claims 12-13, 32-33 and 41-44 stand rejected under 35 USC §112, second paragraph, as failing to failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. See Office Action, p. 16 (27 May, 2008).

Claims 1, 7-11, 21, and 27-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Madden ("The Design of an Acquisitional Query Processor for Sensor Networks," by Madden, Samuel et al., SIGMOD, 09 June 2003). See Office Action, p. 18 (27 May, 2008).

Claims 1, 12, 14, 15, 18-21, 32, 34, 35, 38-40, and 45 are rejected under 35 U.S.C. 102(b) as being anticipated by Mulgund et al (U.S. Pub. No. 2002/0161751) See Office Action, p. 20 (27 May, 2008).

Claims 2 and 22 stand rejected under 35 USC §103(a) as being anticipated by Madden in view of Chiloyan et al. (U.S Patent 7,165,109) See Office Action, p. 22 (27 May, 2008).

Claims 3-6 and 23-26 stand rejected under 35 USC §103(a) as being anticipated by Madden in view of Godlewski et al. (U.S Patent 6,421,354) See Office Action, p. 23 (27 May, 2008).

Claims 13, 33 and 41-44 stand rejected under 35 USC §103(a) as being anticipated by Mulgund in view of Madden. See Office Action, p. 24 (27 May, 2008).

Claims 16, 17, 36 and 37 stand rejected under 35 USC §103(a) as being anticipated by Mulgund et al. in view of King et al. (U.S Publication No. 2005/0021724) See Office Action, p. 27 (27 May, 2008).

Claims 1-45 remain pending for examination.

II. ISSUES TO BE REVIEWED

The issues in this response relate to whether the art of record establishes a *prima facie* case of anticipation of Applicant's Claims 1-45, and whether the art of record establishes a *prima facie* case of unpatentability of Applicant's Claims 1-45. For reasons set forth elsewhere herein, Applicant respectfully asserts that the art of record does not establish a *prima facie* case of anticipation or unpatentability of any pending claim. Accordingly, Applicant respectfully requests that Examiner hold all pending Claims 1-45 allowable for at least the reasons described herein, and issue a Notice of Allowance on same.

III. ARGUMENT: ART OF RECORD DOES NOT ESTABLISH *PRIMA FACIE* CASE OF UNPATENTABILITY IN VIEW OF CITED ART OF RECORD

Applicant respectfully asserts herein that, under the MPEP and legal standards for patentability as set forth below, the art of record does not establish a *prima facie* case of the unpatentability of Applicant's claims at issue. Specifically, Applicant respectfully shows below that the art of record does not recite the text of Applicant's claims at issue, and hence fails to establish a *prima facie* case of unpatentability. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections and hold all claims to be allowable over the art of record.

A. MPEP Standards for Patentability[1]

The MPEP states as follows: "the examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability. If that burden is met, the burden of coming forward with evidence or argument shifts to the applicant. . . If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent." *MPEP* § 2107 (citing *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992)); *In Re Glaug*, 283 F.3d 1335, 62 USPQ2d 1151 (Fed. Cir. 2002) ("During patent

[1] Applicant is aware that Examiner is familiar with the MPEP standards. Applicant is merely setting forth the MPEP standards to serve as a framework for Applicant's arguments following and to ensure a complete written record is established. Should Examiner disagree with Applicant's characterization of the MPEP standards, Applicant respectfully requests correction.

examination the PTO bears the initial burden of presenting a *prima facie* case of unpatentability. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Piasecki*, 745 F.2d 1468, 1472, 252 U.S.P.Q. 785, 788 (Fed. Cir. 1984). If the PTO fails to meet this burden, then the applicant is entitled to the patent."). Accordingly, unless and until an examiner presents evidence establishing *prima facie* unpatentability, an applicant is entitled to a patent on all claims presented for examination.

1. MPEP Standards for Determining Anticipation

An examiner bears the initial burden of factually supporting any *prima facie* conclusion of anticipation. *Ex Parte Skinner*, 2 U.S.P.Q.2d 1788, 1788-89 (B.P.A.I. 1986); *In Re King*, 801 F.2d 1324, 521 U.S.P.Q. (BNA) 136 (Fed. Cir. 1986); *MPEP* § 2107 (citing *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992) ("[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability....")). Failure of an examiner to meet this burden entitles an applicant to a patent. *Id.* ("[i]f examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent").

The MPEP indicates that in order for an examiner to establish a *prima facie* case of anticipation of an applicant's claim, the examiner must first interpret the claim,[2] and thereafter show that the cited prior art discloses the same elements, in the same arrangement, as the elements of the claim which the examiner asserts is anticipated. More specifically, the MPEP states that "[a] claim is anticipated *only if each and every element as set forth in the claim is found*, either expressly or inherently described, in a single prior art reference. . . . The identical invention must be shown in as complete detail as is contained in the . . . claim. . . . The elements must be arranged as required by the claim . . . ." *MPEP* § 2131 (emphasis added). Consequently, under the guidelines of

[2] With respect to interpreting a claim at issue, the MPEP directs that, during examination -- as opposed to subsequent to issue -- such claim be interpreted as broadly as the claim terms would reasonably allow, in light of the specification, when read by one skilled in the art with which the claimed invention is most closely connected. *MPEP* § 2111.

the MPEP set forth above, if there is *any* substantial difference between the prior art cited by an examiner and an applicant's claim which the examiner asserts is rendered anticipated by the prior art, the prior art does NOT establish a *prima facie* case of anticipation and, barring other rejections, the applicant is entitled to a patent on such claim.

2. MPEP Standards for Determining Obviousness

"[T]he examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness."[3] *MPEP* § 2142. The MPEP indicates that in order for an examiner to establish a *prima facie* case that an invention, as defined by a claim at issue, is obvious, the examiner must (1) interpret the claim at issue; (2) define one or more prior art reference components relevant to the claim at issue; (3) ascertain the differences between the one or more prior art reference components and the elements of the claim at issue; and (4) adduce objective evidence which establishes, under a preponderance of the evidence standard, a teaching to modify the teachings of the prior art reference components such that the prior art reference components can be used to construct a device substantially equivalent to the claim at issue. This last step generally encompasses two sub-steps: (1) adducement of objective evidence teaching how to modify the prior art components to achieve the individual elements of the claim at issue; and (2) adducement of objective evidence teaching how to combine the modified individual components such that the claim at issue, as a whole, is achieved. *MPEP* § 2141; *MPEP* § 2143. Each of these forgoing elements is further defined within the MPEP. *Id.*

This requirement has been explained recently by the Supreme Court in *KSR v. Teleflex, 550 U.S. _____; 127 S. Ct. 1727 (2007)* which noted that such a rejection requires "some articulated reasoning ... to support the legal conclusion of obviousness." As stated by the Court, obviousness can be established where "there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To

---

[3] An invention, as embodied in the claims, is rendered obvious if an examiner concludes that although the claimed invention is not identically disclosed or described in a reference, the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *MPEP* § 2141 (citing 35 U.S.C. § 103).

facilitate review, ***this analysis should be made explicit.***" (*emphasis added*) See In re Kahn, 441 F. 3d 977, 988 (CA Fed. 2006) ('[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.')." *KSR v. Teleflex, 550 U.S. _____; 127 S. Ct. 1727 at 1741.*

As further described by the Court ***"[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.*** Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *KSR v. Teleflex, 550 U.S. _____; 127 S. Ct. 1727 at 1741.*

a) Interpreting a Claim at Issue

With respect to interpreting a claim at issue, the MPEP directs that, during examination -- as opposed to subsequent to issue -- such claim be interpreted as broadly as the claim terms would reasonably allow when read by one skilled in the art with which the claimed invention is most closely connected. In practice, this is achieved by giving each of the terms in the claim the "plain meaning" of the terms as such would be understood by those having ordinary skill in the art, and if portions of the claim have no "plain meaning" within the art, or are ambiguous as used in a claim, then the examiner is to consult the specification for clarification. *MPEP* § 2111.

b) Definition of One or More Prior Art Reference Components Relevant to the Claim at Issue

Once the claim at issue has been properly interpreted, the next step is the definition of one or more prior art reference components (*e.g.*, electrical, mechanical, or

other components set forth in a prior art reference) relevant to the properly interpreted claim at issue. With respect to the definition of one or more prior art reference components relevant to the claim at issue, the MPEP defines three proper sources of such prior art reference components, with the further requirement that each such source must have been extant at the time of invention to be considered relevant. These three sources are as follows: patents as defined by 35 U.S.C. §102, printed publications as defined by 35 U.S.C. §102, and information (*e.g.*, scientific principles) deemed to be "well known in the art"[4] as defined under 35 U.S.C. §102. *MPEP* § 2141; *MPEP* § 2144.

c) Ascertainment of Differences between Prior Art Reference Components and Claim at Issue; Teaching to Modify and/or Combine Prior Art Reference Components to Remedy Those Differences in Order to Achieve Recitations of Claim at Issue

With one or more prior art components so defined and drawn from the proper prior art sources, the differences between the one or more prior art reference components and the elements of the claim at issue are to be ascertained. Thereafter, in order to establish a case of *prima facie* obviousness, an examiner must set forth a rationale, supported by objective evidence[5] sufficient to demonstrate under a preponderance of the evidence standard, that in the prior art extant at the time of invention there was a teaching to modify and/or combine the one or more prior art reference components to construct a device practicably equivalent to the claim at issue.

---

[4] The fact that information deemed to be "well known in the art" can serve as a proper source of prior art reference components seems to open the door to subjectivity, but such is not the case. As a remedy to this potential problem, *MPEP* § 2144.03 states that if an examiner asserts that his position is derived from and/or is supported by a teaching or suggestion that is alleged to have been "well known in the art," and that if an applicant traverses such an assertion (that something was "well known within the art"), the examiner must cite a reference in support of his or her position. The same MPEP section also states that when a rejection is based on facts within the personal knowledge of an examiner, the data should be stated as specifically as possible, and the facts must be supported, when called for by the applicant, by an affidavit from the examiner. Such an affidavit is subject to contradiction or explanation by the affidavits of the applicant and other persons. *Id.* Thus, all sources of prior art reference components must be objectively verifiable.

[5] The proper sources of the objective evidence supporting the rationale are the defined proper sources of prior art reference components, discussed above, with the addition of factually similar legal precedent. *MPEP* § 2144.

The preferable evidence relied upon is an express teaching to modify/combine within the properly defined objectively verifiable sources of prior art. In the absence of such express teaching, an examiner may attempt to establish a rationale to support a finding of such teaching reasoned from, or based upon, express teachings taken from the defined proper sources of such evidence (*i.e.*, properly defined objectively verifiable sources of prior art). *MPEP* § 2144; *In re Dembiczak*, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999).

The MPEP recognizes the pitfalls associated with the tendency to subconsciously use impermissible "hindsight" when an examiner attempts to establish such a rationale. The MPEP has set forth at least two rules to ensure against the likelihood of such impermissible use of hindsight. The first rule is that:

> under 35 U.S.C. 103, the examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. In view of all factual information,[6] the examiner must then make a determination whether the claimed invention "as a whole" would have been obvious at that time to that person. Knowledge of an Applicant's disclosure must be put aside in reaching this determination, yet kept in mind in order to determine the "differences," conduct the search, and evaluate the "subject matter as a whole" of the invention. The tendency to resort to "hindsight" based upon an Applicant's disclosure is often difficult to avoid due to the very nature of the examination process. However, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art.

MPEP § 2142 (emphasis added). Thus, if the only objective evidence of such teaching to modify and/or combine prior art reference components is an applicant's disclosure, no evidence of such teaching exists.[7]

---

[6] "Factual information" is information actually existing or occurring, as distinguished from mere supposition or opinion. *Black's Law Dictionary* 532 (5th ed. 1979).

[7] An applicant may argue that an examiner's conclusion of obviousness is based on improper hindsight reasoning. However, "[a]ny judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, such a reconstruction is proper." *MPEP* § 2145(X)(A) (emphasis added).

The second rule is that if an examiner attempts to rely on some advantage or expected beneficial result that would have been produced by a modification and/or combination of the prior art reference components as evidence to support a rationale to establish such teachings to modify and/or combine prior art reference components, the MPEP requires that such advantage or expected beneficial result be objectively verifiable teachings present in the acceptable sources of prior art (or drawn from a convincing line of reasoning based on objectively verifiable established scientific principles or teachings). *MPEP* § 2144. Thus, as a guide to avoid the use of impermissible hindsight, these rules from the MPEP make clear that absent some objective evidence, sufficient to persuade under a preponderance of the evidence standard, no teaching of such modification and/or combination exists.[8]

---

[8] *In Re Sang Su Lee* 277 F.3d 1338 (Fed. Cir. 2002) ("When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness.") *See, e.g., McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351-52, 60 U.S.P.Q.2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the *Graham* factors). *"The factual inquiry whether to combine references must be thorough and searching." Id. It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with. See, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124-25, 56 U.S.P.Q.2d 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding'") (quoting *C.R. Bard, Inc., v. M3 Systems, Inc.*, 157 F.3d 1340, 1352, 48 U.S.P.Q.2d 1225, 1522 (Fed. Cir. 1998)); *In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); *In re Dance*, 160 F.3d 1339, 1343, 48 U.S.P.Q.2d 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant); *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988) ("'teachings of references can be combined only if there is some suggestion or incentive to do so.'") (emphasis in original) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984)). The need for specificity pervades this authority. *See, e.g., In re Kotzab*, 217 F.3d 1365, 1371, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed"); *In re Rouffet*, 149 F.3d 1350, 1359, 47 U.S.P.Q.2d 1453, 1457-58 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.")).

B. Technical Material Cited by Examiner Madden ("The Design of an Acquisitional Query Processor for Sensor Networks") Does Not Show or Suggest the Text of Amended Independent Claim 1 as Presented Herein; Notice of Allowance of Same Respectfully Requested

1. Amended Independent Claim 1

Amended Independent Claim 1 recites:

> 1. A method comprising:
> determining at least one of a sensing function or a control function at a first mote of a second mote; and
> creating one or more mote-addressed *content indexes of the second mote at the first* more in response to said determining. (emphasis added)

As shown in the following, the technical material cited by the Examiner does not show or suggest the text of Independent Claim 1. Accordingly, Applicant respectfully requests that Examiner allow Independent Claim 1.

a) Technical Material Cited by Examiner Does Not Show or Suggest the Text of at Least Amended Independent Claim 1.

As set forth above, Independent Claim 1 recites:

> 1. A method comprising:
> [a] determining at least one of a sensing function or a control function at a first mote of a second mote; and
> [b] creating one or more mote-addressed *content indexes of the second mote at the first mote* in response to said determining.[9] (Emphases added.)

With respect to Claim 1, Examiner has stated,

> "As to claims 1 and 21, Madden et al. shows
> determining at least one of a sensing function or a control function at a mote [sampling a sensors to evaluate any predicate over the attribute sensors (section 4.2 Ordering of Sampling And Predicates)]; and

[9] The lettering of the clauses herein is merely for sake of clarity of argument and should not be taken to imply any particular ordering of the clauses.

creating one or more mote-addressed content indexes in response to said determining [creating and maintaining a catalog of metadata that describes a particular mote's local attributes, events, and information about the costs of processing and delivering data (section 4.1 Metadata Management, and Table 2, and 3)].

Madden also shows that recited functions are performed by a TinyDB (section 1 Introduction, paragraph 4)."

See Examiner's *Office Action*, p. 18 (May 27, 2008).

(1) Examiner Citations With Regard to Clause [b] of Independent Claim 1

Applicant respectfully points out that Applicant has reviewed the portions of Madden identified by Examiner, and so far as Applicant can discern, Madden does not recite or suggest the text of clause [b] of Applicant's Independent Claim 1. Rather, the portions of Madden cited by Examiner recites as follows:

4.1 Metadata Management

Each node in TinyDB maintains a catalog of metadata that describes its local attributes, events, and user-defined functions. This metadata is periodically copied to the root of the network for use by the optimizer. Metadata is registered with the system via static linking done at compile time using the TinyOS C-like programming language. Events and attributes pertaining to various operating system and TinyDB components are made available to queries by declaring them in an interface file and providing a small handler function. For example, in order to expose network topology to the query processor, the TinyOS `Network` component defines the attribute `parent` of type integer and registers a handler that returns the id of the node's parent in the current routing tree.

Event metadata consists of a name, a signature, and a frequency estimate that is used in query optimization (see Section 4.3 below.) User-defined predicates also have a name and a signature, along with a selectivity estimate which is provided by the author of the function.

Metadata	Description
Power	Cost to sample this attribute (in J)
Sample Time	Time to sample this attribute (in s)
Constant?	Is this attribute constant-valued (e.g. id)?
Rate of Change	How fast the attribute changes (units/s)
Range	Dynamic range of attribute values (pair of units)

Table 2: Metadata fields kept with each attribute

Table 2 summarizes the metadata associated with each attribute, along with a brief description. Attribute metadata is used primarily in two contexts: information about the cost, time to fetch, and range of an attribute is used in query optimization, while information about the semantic properties of attributes is used in query dissemination and result processing. Table 3 gives examples of power and sample time values for some actual sensors – notice that the power consumption and time to sample can differ across sensors by several orders of magnitude.

Sensor	Power mW	Sample time ms	Sample Energy (VI * t), uJ
Light, Temp	.9	.1 [5]	90
Magnetometer	15 [24]	.1 [5]	1500
Accelerometer	1.8 [3]	.1 [5]	180
Organic Byproducts[5]	15	> 1000	$> 1.5 \times 10^7$

Table 3: Energy costs of accessing various common sensors

The catalog also contains metadata about TinyDB's extensible aggregate system. As with other extensible database systems [44] the catalog includes names of aggregates and pointers to their code. Each aggregate consists of a triplet of functions, that initialize, merge, and update the final value of partial aggregate records as they flow through the system. As in the TAG[34] paper, aggregate authors must provide information about functional properties. In TinyDB, we currently require two: whether the aggregate is *monotonic* and whether it is *exemplary* or *summary*. COUNT is a monotonic aggregate as its value can only get larger as more values are aggregated. MIN is an exemplary aggregate, as it returns a single value from the set of aggregate values, while AVERAGE is a summary aggregate because it computes some property over the entire set of values.

TinyDB also stores metadata information about the costs of processing and delivering data, which is used in query-lifetime estimation. The costs of these phases in TinyDB were shown in Figure 2 – they range from 2 mA while sleeping, to over 20 mA while transmitting and processing. Note that actual costs vary from mote to mote – for example, with a small sample of 5 motes (using the same batteries), we found that the average current with processor active varied from 13.9 to 17.6 mA (with the average being 15.66 mA).

See *Madden* (Section 4.1)

4.2 Ordering of Sampling And Predicates

Having described the metadata maintained by TinyDB, we now describe how it is used in query optimization.

As Table 3 shows, sampling is often an expensive operation in terms of power. However, a sample from a sensor s must be taken to evaluate any predicate over the attribute `sensors.s`. If a predicate discards a tuple of the `sensors` table, then subsequent predicates need not examine the tuple – and hence the expense of sampling any attributes referenced in those subsequent predicates can be avoided. Thus these predicates are "expensive", and need to be ordered carefully. The predicate ordering problem here is somewhat different than than in the earlier literature (e.g. [21]) because (a) an attribute may be referenced in multiple predicates, and (b) expensive predicates are only on a single table, `sensors`. The first point introduces some subtlety, as it is not clear which predicate

should be "charged" the cost of the sample.

To model this issue, we treat the sampling of a sensor t as a separate "job" τ to be scheduled along with the predicates. Hence a set of predicates $P = \{p_1, \ldots, p_n\}$ is rewritten as a set of operations $S = \{s_1, \ldots, s_n\}$, where $P \subset S$, and $S - P = \{\tau_1, \ldots, \tau_{n-m}\}$ contains one sampling operator for each distinct attribute referenced in P. The selectivity of sampling operators is always 1. The selectivity of selection operators is derived by assuming that attributes have a uniform distribution over their range (which is available in the catalog.) Relaxing this assumption by, for example, storing histograms or time-dependent functions per-attribute remains an area of future work. The cost of an operator (predicate or sample) can be determined by consulting the metadata, as described in the previous section. In the cases we discuss here, selections and joins are essentially "free" compared to sampling, but this is not a requirement of our technique.

We also introduce a partial order on S, where τ_i must precede p_j if p_j references the attribute sampled by τ_i. The combination of sampling operators and the dependency of predicates on samples captures the costs of sampling operators and the sharing of operators across predicates.

The partial order induced on S forms a graph with edges from sampling operators to predicates. This is a simple *series-parallel* graph. An optimal ordering of jobs with series-parallel constraints is a topic treated in the Operations Research literature that inspired earlier optimization work [25, 30, 21]; Monma and Sidney present the *Series-Parallel Algorithm Using Parallel Chains* [38], which gives an optimal ordering of the jobs in $O(|S| \log |S|)$ time.

Due to space constraints, we have glossed over the details of handling the expensive nature of sampling in the SELECT, GROUP BY, and HAVING clauses. The basic idea is to add them to S with appropriate selectivities, costs, and ordering constraints.

As an example of this process, consider the query:

```
SELECT accel,mag
  FROM sensors
  WHERE accel > c1
  AND mag > c2
  SAMPLE INTERVAL 1s
```

The order of magnitude difference in per-sample costs for the accelerometer and magnetometer suggests that the power costs of plans with different orders of sampling and selection will vary substantially. We consider three possible plans: in the first, the magnetometer and accelerometer are sampled before either selection is applied. In the second, the magnetometer is sampled and the selection over its reading (which we call S_{mag}) is applied before the accelerometer is sampled or filtered. In the third plan, the accelerometer is sampled first and its selection (S_{accel}) is applied before the magnetometer is sampled. We compared the cost of these three plans, and, as expected, found that the first was always more expensive than the other two. More interestingly, the second can be an order of magnitude more expensive than third, when S_{accel} is much more selective than S_{mag}. Conversely, when S_{mag} is highly selective, it can be cheaper to sample the magnetometer first, although only by a small factor (.5). The order of magnitude difference in relative costs represents an absolute difference of 1320 uJ per sample, or 3.96 mW at a (slow) sample rate of one sample per second – putting the additional power consumption from sampling in the incorrect order on par with the power costs of running the radio or CPU for an entire second.

Similarly, we note that there are certain kinds of aggregate functions where the same kind of interleaving of sampling and processing can also lead to a performance savings. Consider the query:

```
SELECT MAX(light)
  FROM sensors
  WHERE mag > x
  SAMPLE INTERVAL 8s
```

In this query, the maximum light reading will be computed over all the nodes in the network whose magnetometers read greater than x. Interestingly, it turns out that, unless the `mag > x` predicate is *very* selective, it will be cheaper to evaluate this query by checking to see if each new `light` reading is greater than the previous maximum and then applying

the selection predicate over mag, rather than first sampling mag. This sort of reordering, which we call *exemplary aggregate pushdown* can be applied to any exemplary aggregate (e.g. MIN, MAX). Unfortunately, the selectivities of exemplary aggregates are very hard to capture, especially for window aggregates. We reserve the problem of ordering exemplary aggregates in query optimization for future work.

See *Madden* (Section 4.2)

We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica *mote* platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption *and* increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

See *Madden* (Introduction, Paragraph 4)

As can be seen from the foregoing, the Examiner-identified portions of Madden do <u>*not recite*</u> the text of clause [b] as recited in Independent Claim 1. For example, Madden teaches "Each node in TindyDB maintains a catalog of metadata that describes *its local attributes, events and user-defined functions*." (Emphasis added) On the other hand, clause (b) recites "creating one or more mote-addressed *content indexes of the second mote at the first* more in response to said determining." (emphasis added). The cited text does not show or recite "*content indexes of the second mote at the first.*"

Applicant has reviewed the Examiner-cited portions of Madden and is unable to locate a recitation of clause (b) of Claim 1. Applicant further respectfully points out that the Examiner has provided no objectively verifiable evidence, or argument based on objectively verifiable evidence, as to why the text of the reference passages should be interpreted to teach clause (b) of amended Independent Claim 1.

Given that Applicant has shown, above, what Madden actually recites, the question thus naturally arises as to how Examiner saw Madden as "teaching" something

related to Clause (b) of Independent Claim 1. Applicant respectfully points out that the Applicant's Application is the only objectively verifiable examiner-cited document of record that shows or suggests what Examiner purports the reference to teach. From this and the express recitations of Madden as set forth, it follows that Examiner is interpreting Madden through the lens of Applicant's application, which is impermissible hindsight use. Thus, at present, Examiner's assertions regarding Madden are untenable. Under the MPEP guidelines as set forth above, the cited art of record fails to establish a prima facie case of unpatentability for at least these reasons. Accordingly, for at least the foregoing reasons, Applicant respectfully requests that Examiner hold Independent Claim 1 allowable and issue a Notice of Allowability of same.

In the alternative and/or in addition to the foregoing, as Examiner has provided no objectively verifiable evidence, nor argument based on objectively verifiable evidence, in support of Examiner assertions regarding what the technical material cited by Examiner "teaches," Applicant infers that the Examiner is relying on "personal knowledge" and/or is taking "official notice" of one or more factors to reach the factual conclusion of what the cited technical material "teaches." In view of the foregoing, if Examiner desires to maintain the rejection, in the next communication, Applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth objectively verifiable evidence in support of Examiner's currently unsupported assertions regarding what the cited technical material "teaches" and/or should be interpreted to "teach." *See, e.g.*, MPEP §2144.03(C), *If Applicant Challenges a Factual Assertion as Not Properly Officially Notices or Not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding with Adequate Evidence*, and 37 C.F.R. 1.104(d)(2).

In view of the foregoing, and under the MPEP standards as set forth above, Applicant respectfully submits that the Examiner-cited art does not establish a *prima facie* case of unpatentability of Independent Claim 1. Accordingly, for at least the foregoing reasons, Applicant respectfully asks Examiner to hold Independent Claim 1 allowable and to issue a Notice of Allowance of same.

C. Technical Material Cited by Examiner Madden ("The Design of an Acquisitional Query Processor for Sensor Networks") Does Not Show or Suggest the Text of Amended Independent Claim 21 as Presented Herein; Notice of Allowance of Same Respectfully Requested

1. Amended Independent Claim 21

Amended Independent Claim 21 recites:

> 21. A system comprising:
> means, including a storage medium, for determining at least one of a sensing function or a control function of a second mote at a first mote; and
> means for creating one or more mote-addressed content indexes *of the second mote at the first mote* in response to said determining. (emphasis added)

As shown in the following, the technical material cited by the Examiner does not show or suggest the text of Independent Claim 21. Accordingly, Applicant respectfully requests that Examiner allow Independent Claim 21.

a) Technical Material Cited by Examiner Does Not Show or Suggest the Text of at Least Amended Independent Claim 21.

As set forth above, Independent Claim 21 recites:

> 21. A system comprising:
> [a] means, including a storage medium, for determining at least one of a sensing function or a control function of a second mote at a first mote; and
> [b] means for *creating* one or more mote-addressed content indexes *of the second mote at the first* mote in response to said determining. (Emphases added.)

With respect to Claim 21, Examiner has stated,

"As to claims 1 and 21, Madden et al. shows
determining at least one of a sensing function or a control function at a mote [sampling a sensors to evaluate any predicate over the attribute sensors (section 4.2 Ordering of Sampling And Predicates)]; and
creating one or more mote-addressed content indexes in response to said determining [creating and maintaining a catalog of metadata that

describes a particular mote's local attributes, events, and information about the costs of processing and delivering data (section 4.1 Metadata Management, and Table 2, and 3)].

Madden also shows that recited functions are performed by a TinyDB (section 1 Introduction, paragraph 4)."

See Examiner's *Office Action*, p. 18 (May 27, 2008).

(1) Examiner Citations With Regard to Clause [b] of Independent Claim 21

Applicant respectfully points out that Applicant has reviewed the portions of Madden identified by Examiner, and so far as Applicant can discern, Madden does not recite the text of clause [b] of Applicant's Independent Claim 21. Rather, the portions of Madden cited by Examiner recites as follows:

4.1 Metadata Management

Each node in TinyDB maintains a catalog of metadata that describes its local attributes, events, and user-defined functions. This metadata is periodically copied to the root of the network for use by the optimizer. Metadata is registered with the system via static linking done at compile time using the TinyOS C-like programming language. Events and attributes pertaining to various operating system and TinyDB components are made available to queries by declaring them in an interface file and providing a small handler function. For example, in order to expose network topology to the query processor, the TinyOS `Network` component defines the attribute `parent` of type integer and registers a handler that returns the id of the node's parent in the current routing tree.

Event metadata consists of a name, a signature, and a frequency estimate that is used in query optimization (see Section 4.3 below.) User-defined predicates also have a name and a signature, along with a selectivity estimate which is provided by the author of the function.

Metadata	Description
Power	Cost to sample this attribute (in J)
Sample Time	Time to sample this attribute (in s)
Constant?	Is this attribute constant-valued (e.g. id)?
Rate of Change	How fast the attribute changes (units/s)
Range	Dynamic range of attribute values (pair of units)

Table 2: Metadata fields kept with each attribute

Table 2 summarizes the metadata associated with each attribute, along with a brief description. Attribute metadata is used primarily in two contexts: information about the cost, time to fetch, and range of an attribute is used in query optimization, while information about the semantic properties of attributes is used in query dissemination and result processing. Table 3 gives examples of power and sample time values for some actual sensors – notice that the power consumption and time to sample can differ across sensors by several orders of magnitude.

Sensor	Power mW	Sample time ms	Sample Energy (VI * t), uJ
Light, Temp	.9	.1 [5]	90
Magnetometer	15 [24]	.1 [5]	1500
Accelerometer	1.8 [3]	.1 [5]	180
Organic Byproducts[5]	15	> 1000	$> 1.5 \times 10^7$

Table 3: Energy costs of accessing various common sensors

The catalog also contains metadata about TinyDB's extensible aggregate system. As with other extensible database systems [44] the catalog includes names of aggregates and pointers to their code. Each aggregate consists of a triplet of functions, that initialize, merge, and update the final value of partial aggregate records as they flow through the system. As in the TAG[34] paper, aggregate authors must provide information about functional properties. In TinyDB, we currently require two: whether the aggregate is *monotonic* and whether it is *exemplary* or *summary*. COUNT is a monotonic aggregate as its value can only get larger as more values are aggregated. MIN is an exemplary aggregate, as it returns a single value from the set of aggregate values, while AVERAGE is a summary aggregate because it computes some property over the entire set of values.

TinyDB also stores metadata information about the costs of processing and delivering data, which is used in query-lifetime estimation. The costs of these phases in TinyDB were shown in Figure 2 – they range from 2 mA while sleeping, to over 20 mA while transmitting and processing. Note that actual costs vary from mote to mote – for example, with a small sample of 5 motes (using the same batteries), we found that the average current with processor active varied from 13.9 to 17.6 mA (with the average being 15.66 mA).

See *Madden* (Section 4.1)

4.2 Ordering of Sampling And Predicates

Having described the metadata maintained by TinyDB, we now describe how it is used in query optimization.

As Table 3 shows, sampling is often an expensive operation in terms of power. However, a sample from a sensor s must be taken to evaluate any predicate over the attribute `sensors.s`. If a predicate discards a tuple of the `sensors` table, then subsequent predicates need not examine the tuple – and hence the expense of sampling any attributes referenced in those subsequent predicates can be avoided. Thus these predicates are "expensive", and need to be ordered carefully. The predicate ordering problem here is somewhat different than than in the earlier literature (e.g. [21]) because (a) an attribute may be referenced in multiple predicates, and (b) expensive predicates are only on a single table, `sensors`. The first point introduces some subtlety, as it is not clear which predicate

should be "charged" the cost of the sample.

To model this issue, we treat the sampling of a sensor t as a separate "job" τ to be scheduled along with the predicates. Hence a set of predicates $P = \{p_1, \ldots, p_n\}$ is rewritten as a set of operations $S = \{s_1, \ldots, s_m\}$, where $P \subset S$, and $S - P = \{\tau_1, \ldots, \tau_{n-m}\}$ contains one sampling operator for each distinct attribute referenced in P. The selectivity of sampling operators is always 1. The selectivity of selection operators is derived by assuming that attributes have a uniform distribution over their range (which is available in the catalog.) Relaxing this assumption by, for example, storing histograms or time-dependent functions per-attribute remains an area of future work. The cost of an operator (predicate or sample) can be determined by consulting the metadata, as described in the previous section. In the cases we discuss here, selections and joins are essentially "free" compared to sampling, but this is not a requirement of our technique.

We also introduce a partial order on S, where τ_i must precede p_j if p_j references the attribute sampled by τ_i. The combination of sampling operators and the dependency of predicates on samples captures the costs of sampling operators and the sharing of operators across predicates.

The partial order induced on S forms a graph with edges from sampling operators to predicates. This is a simple *series-parallel* graph. An optimal ordering of jobs with series-parallel constraints is a topic treated in the Operations Research literature that inspired earlier optimization work [25, 30, 21]; Monma and Sidney present the *Series-Parallel Algorithm Using Parallel Chains* [38], which gives an optimal ordering of the jobs in $O(|S| \log |S|)$ time.

Due to space constraints, we have glossed over the details of handling the expensive nature of sampling in the SELECT, GROUP BY, and HAVING clauses. The basic idea is to add them to S with appropriate selectivities, costs, and ordering constraints.

As an example of this process, consider the query:

```
SELECT accel,mag
  FROM sensors
  WHERE accel > c1
  AND mag > c2
  SAMPLE INTERVAL 1s
```

The order of magnitude difference in per-sample costs for the accelerometer and magnetometer suggests that the power costs of plans with different orders of sampling and selection will vary substantially. We consider three possible plans: in the first, the magnetometer and accelerometer are sampled before either selection is applied. In the second, the magnetometer is sampled and the selection over its reading (which we call S_{mag}) is applied before the accelerometer is sampled or filtered. In the third plan, the accelerometer is sampled first and its selection (S_{accel}) is applied before the magnetometer is sampled. We compared the cost of these three plans, and, as expected, found that the first was always more expensive than the other two. More interestingly, the second can be an order of magnitude more expensive than third, when S_{accel} is much more selective than S_{mag}. Conversely, when S_{mag} is highly selective, it can be cheaper to sample the magnetometer first, although only by a small factor (.8). The order of magnitude difference in relative costs represents an absolute difference of 1320 uJ per sample, or 3.96 mW at a (slow) sample rate of one sample per second – putting the additional power consumption from sampling in the incorrect order on par with the power costs of running the radio or CPU for an entire second.

Similarly, we note that there are certain kinds of aggregate functions where the same kind of interleaving of sampling and processing can also lead to a performance savings. Consider the query:

```
SELECT MAX(light)
  FROM sensors
  WHERE mag > x
  SAMPLE INTERVAL 8s
```

In this query, the maximum light reading will be computed over all the nodes in the network whose magnetometers read greater than x. Interestingly, it turns out that, unless the `mag > x` predicate is *very* selective, it will be cheaper to evaluate this query by checking to see if each new `light` reading is greater than the previous maximum and then applying

the selection predicate over mag, rather than first sampling mag. This sort of reordering, which we call exemplary aggregate pushdown can be applied to any exemplary aggregate (e.g. MIN, MAX). Unfortunately, the selectivities of exemplary aggregates are very hard to capture, especially for window aggregates. We reserve the problem of ordering exemplary aggregates in query optimization for future work.

See *Madden* (Section 4.2)

We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica *mote* platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption *and* increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

See *Madden* (Introduction, Paragraph 4)

As can be seen from the foregoing, the Examiner-identified portions of Madden do <u>*not recite*</u> the text of clause [b] as recited in Independent Claim 21. For example, Madden teaches "Each node in TindyDB maintains a catalog of metadata that describes *its local attributes, events and user-defined functions*." (Emphasis added) On the other hand, clause (b) recites "means for *creating* one or more mote-addressed *content indexes of the second mote at the first mote* in response to said determining." (emphasis added). The cited text does not show or recite "*creating ... content indexes of the second mote at the first mote.*"

Applicant has reviewed the Examiner-cited portions of Madden and is unable to locate a recitation of clause (b) of Claim 21. Applicant further respectfully points out that the Examiner has provided no objectively verifiable evidence, or argument based on objectively verifiable evidence, as to why the text of the reference passages should be interpreted to teach clause (b) of amended Independent Claim 21.

Given that Applicant has shown, above, what Madden actually recites, the question thus naturally arises as to how Examiner saw Madden as "teaching" something related to Clause (b) of Independent Claim 21. Applicant respectfully points out that the Applicant's Application is the only objectively verifiable examiner-cited document of record that shows or suggests what Examiner purports the reference to teach. From this and the express recitations of Madden as set forth, it follows that Examiner is interpreting Madden through the lens of Applicant's application, which is impermissible hindsight use. Thus, at present, Examiner's assertions regarding Madden are untenable. Under the MPEP guidelines as set forth above, the cited art of record fails to establish a prima facie case of unpatentability for at least these reasons. Accordingly, for at least the foregoing reasons, Applicant respectfully requests that Examiner hold Independent Claim 21 allowable and issue a Notice of Allowability of same.

In the alternative and/or in addition to the foregoing, as Examiner has provided no objectively verifiable evidence, nor argument based on objectively verifiable evidence, in support of Examiner assertions regarding what the technical material cited by Examiner "teaches," Applicant infers that the Examiner is relying on "personal knowledge" and/or is taking "official notice" of one or more factors to reach the factual conclusion of what the cited technical material "teaches." In view of the foregoing, if Examiner desires to maintain the rejection, in the next communication, Applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth objectively verifiable evidence in support of Examiner's currently unsupported assertions regarding what the cited technical material "teaches" and/or should be interpreted to "teach." *See, e.g.*, MPEP §2144.03(C), *If Applicant Challenges a Factual Assertion as Not Properly Officially Notices or Not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding with Adequate Evidence*, and 37 C.F.R. 1.104(d)(2).

In view of the foregoing, and under the MPEP standards as set forth above, Applicant respectfully submits that the Examiner-cited art does not establish a *prima facie* case of unpatentability of Independent Claim 21. Accordingly, for at least the foregoing reasons, Applicant respectfully asks Examiner to hold Independent Claim 21 allowable and to issue a Notice of Allowance of same.

D. Technical Material Cited by Examiner Mulgund et. al. (U.S. Pub. No. 2002/0161751) Does Not Show or Suggest the Text of Amended Independent Claim 1 as Presented Herein; Notice of Allowance of Same Respectfully Requested

1. Amended Independent Claim 1

Amended Independent Claim 1 recites:

> 1. A method comprising:
> determining at least one of a sensing function or a control function at a first mote of a second mote; and
> creating one or more mote-addressed *content indexes of the second mote at the first* more in response to said determining. (emphasis added)

As shown in the following, the technical material cited by the Examiner does not show or suggest the text of Independent Claim 1. Accordingly, Applicant respectfully requests that Examiner allow Independent Claim 1.

a) Technical Material Cited by Examiner Does Not Show or Suggest the Text of at Least Amended Independent Claim 1.

As set forth above, Independent Claim 1 recites:

> 1. A method comprising:
> [a] determining at least one of a sensing function or a control function at a first mote of a second mote; and
> [b] creating one or more mote-addressed *content indexes of the second mote at the first mote* in response to said determining. (Emphases added.)

With respect to Claim 1, Examiner has stated,

> "As to claims 1 and 21, Mulgund shows
> determining at least one of a sensing function or a control function at a mote [discovering and maintaining the distributed sensor network topology (paragraph [0007]) wherein at least one of a sensing function or a control function is interpreted to be at least one of the data elements outlined in paragraphs 0021 – 0024]; and
> creating one or more mote-addressed content indexes in response to said determining [building a database model by updating relational

database logical design tables at each step of the discovering step (paragraph 0007)].

Mulgund also shows a sensor network modeling agent (summary of the invention) for performing the recited functions."

See Examiner's *Office Action*, p. 20 (May 27, 2008).

(1) Examiner Citations With Regard to Clause [b] of Independent Claim 1

Applicant respectfully points out that Applicant has reviewed the portions of Mulgund identified by Examiner, and so far as Applicant can discern, Mulgund does not recite the text of clause [b] of Applicant's Independent Claim 1. Rather, the portions of Mulgund cited by Examiner recites as follows:

> [0021] an identity (unique identifying information such as a numeric address) of each of the sensing nodes 2 in the network 4, as well as any metadata about each node;
>
> [0022] a connectivity of each of the sensing nodes 2; i.e., a structural representation of the network topology that could be used to reconstruct a diagram such as FIG. 1;
>
> [0023] an up-to-date information content at each of the sensing nodes 2; i.e., a real-time snapshot and time-history of the data of interest generated at each node location by an attached suite of sensors 16, as depicted in FIG. 2; and
>
> [0024] a history of the network 4 from the moment the model was first constructed, which would allow a reconstruction of the network's state at any time in the past.

See *Mulgund* (paragraphs 0021 – 0024)

> [0006] In one aspect, the present invention is an information architecture that permits the Internet to contact distributed sensors at one point, databases and mining engines at another point, and users at another point. In this aspect, the invention is an enabling interface between the Internet and the physical world. Due to the global reach of the Internet, these physical points of contact may be distributed anywhere in the world. The Applicants have invented a sensor network modeling agent for use with a relational database and a logical design resident therein.
>
> [0007] In another aspect, the present invention is a method of database modeling that makes it possible to create, store, and update a virtual model of a network of sensors within a relational database structure. The network modeling agent dynamically updates various sensor node data and link

data that collectively define an instantaneous "state" of the sensor network into the database logical design. The network modeling agent thereby facilitates access, visualization, and the use of a stream of information generated by the network of distributed sensors. The sensor nodes to be interrogated by the network modeling agent are assumed to be uniquely addressable and in communication, using networking protocols, with one another through links and with a database server through one or more access points. A method according to the present invention comprises the steps of discovering and maintaining the distributed sensor network topology by applying at every access point a quasi-recursive algorithm, which causes the network modeling agent to visit a first sensor node and mark the first node visited, push the marked first node onto a stack, and while the stack is non-empty, query the node at the top of the stack for a list of current links to the node at the top, compare the list of current links to a list of historical links to the node at the top of the stack and update the historical link and historical node information, and if there are no unmarked nodes reachable from a current link then pop the stack, otherwise visit the next reachable unmarked node, mark the next node and push it onto the stack. The network modeling agent builds the database model by updating relational database logical design tables at each step of the discovering step. The agent maintains the database model by periodically reapplying the interrogating algorithm, thereby updating the database model to account for sensor node and link additions and deletions. The periodicity of updates is preferably such that a near real-time topology of the sensor network is maintained.

[0008] In another embodiment, the present invention is a method as described above, wherein the logical design tables further comprise a data table for mapping between one or more sensor nodes and the tables used to store the associated sensor output data associated with the one or more sensor nodes.

[0009] In certain embodiments, the present invention is used in modeling networks comprised of mobile sensor nodes. The sensor nodes may communicate by wired or wireless means. The database server used with the present invention may be remotely located from the distributed sensor network.

See *Mulgund* (paragraph [0007] and summary of the invention)

As can be seen from the foregoing, the Examiner-identified portions of Mulgund do *not recite* the text of clause [b] as recited in Independent Claim 1. For example, Mulgund teaches "The database server used with the present invention may be remotely located from the distributed sensor network.." (Emphasis added) On the other hand, clause (b) recites "creating one or more mote-addressed *content indexes of the second*

mote at the first more in response to said determining." (emphasis added). The cited text does not show or recite "*content indexes of the second mote at the first.*"

Applicant has reviewed the Examiner-cited portions of Mulgund and is unable to locate a recitation of clause (b) of Claim 1. Applicant further respectfully points out that the Examiner has provided no objectively verifiable evidence, or argument based on objectively verifiable evidence, as to why the text of the reference passages should be interpreted to teach clause (b) of amended Independent Claim 1.

Given that Applicant has shown, above, what Mulgund actually recites, the question thus naturally arises as to how Examiner saw Mulgund as "teaching" something related to Clause (b) of Independent Claim 1. Applicant respectfully points out that the Applicant's Application is the only objectively verifiable examiner-cited document of record that shows or suggests what Examiner purports the reference to teach. From this and the express recitations of Mulgund as set forth, it follows that Examiner is interpreting Mulgund through the lens of Applicant's application, which is impermissible hindsight use. Thus, at present, Examiner's assertions regarding Mulgund are untenable. Under the MPEP guidelines as set forth above, the cited art of record fails to establish a prima facie case of unpatentability for at least these reasons. Accordingly, for at least the foregoing reasons, Applicant respectfully requests that Examiner hold Independent Claim 1 allowable and issue a Notice of Allowability of same.

In the alternative and/or in addition to the foregoing, as Examiner has provided no objectively verifiable evidence, nor argument based on objectively verifiable evidence, in support of Examiner assertions regarding what the technical material cited by Examiner "teaches," Applicant infers that the Examiner is relying on "personal knowledge" and/or is taking "official notice" of one or more factors to reach the factual conclusion of what the cited technical material "teaches." In view of the foregoing, if Examiner desires to maintain the rejection, in the next communication, Applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth objectively verifiable evidence in support of Examiner's currently unsupported assertions regarding what the cited technical material "teaches" and/or should be interpreted to "teach." *See, e.g.*, MPEP §2144.03(C), *If Applicant Challenges a Factual Assertion as Not Properly*

Officially Notices or Not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding with Adequate Evidence, and 37 C.F.R. 1.104(d)(2).

In view of the foregoing, and under the MPEP standards as set forth above, Applicant respectfully submits that the Examiner-cited art does not establish a *prima facie* case of unpatentability of Independent Claim 1. Accordingly, for at least the foregoing reasons, Applicant respectfully asks Examiner to hold Independent Claim 1 allowable and to issue a Notice of Allowance of same.

2. Dependent Claims 2-20: Patentable for at Least Reasons of Dependency from Independent Claim 1.

Claims 2-20 depend either directly or indirectly from Independent Claim 1. "A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers." *See* 35 U.S.C. §112 paragraph 4. Consequently, Dependent Claims 2-20 are patentable for at least the reasons why Independent Claim 1 is patentable. Accordingly, Applicant respectfully requests that Examiner hold Dependent Claims 2-20 patentable for at least the foregoing reasons, and issue a Notice of Allowance on same.

E. Technical Material Cited by Examiner Mulgund et. al. (U.S. Pub. No. 2002/0161751) Does Not Show or Suggest the Text of Amended Independent Claim 21 as Presented Herein; Notice of Allowance of Same Respectfully Requested

1. Amended Independent Claim 21

Amended Independent Claim 21 recites:

> 21. A system comprising:
>
> means, including a storage medium, for determining at least one of a sensing function or a control function of a second mote at a first mote; and
>
> means for creating one or more mote-addressed content indexes *of the second mote at the first mote* in response to said determining. (emphasis added)

As shown in the following, the technical material cited by the Examiner does not show or suggest the text of Independent Claim 21. Accordingly, Applicant respectfully requests that Examiner allow Independent Claim 21.

a) Technical Material Cited by Examiner Does Not Show or Suggest the Text of at Least Amended Independent Claim 21.

As set forth above, Independent Claim 21 recites:

21. A system comprising:

[a] means, including a storage medium, for determining at least one of a sensing function or a control function of a second mote at a first mote; and

[b] means for *creating* one or more mote-addressed content indexes *of the second mote at the first* mote in response to said determining. (Emphases added.)

With respect to Claim 21, Examiner has stated,

"As to claims 1 and 21, Mulgund shows

determining at least one of a sensing function or a control function at a mote [discovering and maintaining the distributed sensor network topology (paragraph [0007]) wherein at least one of a sensing function or a control function is interpreted to be at least one of the data elements outlined in paragraphs 0021 – 0024]; and

creating one or more mote-addressed content indexes in response to said determining [building a database model by updating relational database logical design tables at each step of the discovering step (paragraph 0007)].

Mulgund also shows a sensor network modeling agent (summary of the invention) for performing the recited functions."

See Examiner's *Office Action*, p. 20 (May 27, 2008).

(1) Examiner Citations With Regard to Clause [b] of Independent Claim 21

Applicant respectfully points out that Applicant has reviewed the portions of Mulgund identified by Examiner, and so far as Applicant can discern, Mulgund does not recite the text of clause [b] of Applicant's Independent Claim 21. Rather, the portions of Mulgund cited by Examiner recites as follows:

[0021] an identity (unique identifying information such as a numeric address) of each of the sensing nodes 2 in the network 4, as well as any metadata about each node;

[0022] a connectivity of each of the sensing nodes 2; i.e., a structural representation of the network topology that could be used to reconstruct a diagram such as FIG. 1;

[0023] an up-to-date information content at each of the sensing nodes 2; i.e., a real-time snapshot and time-history of the data of interest generated at each node location by an attached suite of sensors 16, as depicted in FIG. 2; and

[0024] a history of the network 4 from the moment the model was first constructed, which would allow a reconstruction of the network's state at any time in the past.

See *Mulgund* (paragraphs 0021 – 0024)

[0006] In one aspect, the present invention is an information architecture that permits the Internet to contact distributed sensors at one point, databases and mining engines at another point, and users at another point. In this aspect, the invention is an enabling interface between the Internet and the physical world. Due to the global reach of the Internet, these physical points of contact may be distributed anywhere in the world. The Applicants have invented a sensor network modeling agent for use with a relational database and a logical design resident therein.

[0007] In another aspect, the present invention is a method of database modeling that makes it possible to create, store, and update a virtual model of a network of sensors within a relational database structure. The network modeling agent dynamically updates various sensor node data and link data that collectively define an instantaneous "state" of the sensor network into the database logical design. The network modeling agent thereby facilitates access, visualization, and the use of a stream of information generated by the network of distributed sensors. The sensor nodes to be interrogated by the network modeling agent are assumed to be uniquely addressable and in communication, using networking protocols, with one another through links and with a database server through one or more access points. A method according to the present invention comprises the steps of discovering and maintaining the distributed sensor network topology by applying at every access point a quasi-recursive algorithm, which causes the network modeling agent to visit a first sensor node and mark the first node visited, push the marked first node onto a stack, and while the stack is non-empty, query the node at the top of the stack for a list of current links to the node at the top, compare the list of current links to a list of historical links to the node at the top of the stack and update the historical link and historical node information, and if there are no

> unmarked nodes reachable from a current link then pop the stack, otherwise visit the next reachable unmarked node, mark the next node and push it onto the stack. The network modeling agent builds the database model by updating relational database logical design tables at each step of the discovering step. The agent maintains the database model by periodically reapplying the interrogating algorithm, thereby updating the database model to account for sensor node and link additions and deletions. The periodicity of updates is preferably such that a near real-time topology of the sensor network is maintained.
>
> [0008] In another embodiment, the present invention is a method as described above, wherein the logical design tables further comprise a data table for mapping between one or more sensor nodes and the tables used to store the associated sensor output data associated with the one or more sensor nodes.
>
> [0009] In certain embodiments, the present invention is used in modeling networks comprised of mobile sensor nodes. The sensor nodes may communicate by wired or wireless means. The database server used with the present invention may be remotely located from the distributed sensor network.

See *Mulgund* (paragraph [0007] and summary of the invention)

As can be seen from the foregoing, the Examiner-identified portions of Mulgund do *not recite* the text of clause [b] as recited in Independent Claim 21. For example, Mulgund teaches "The database server used with the present invention may be remotely located from the distributed sensor network.." (Emphasis added) On the other hand, clause (b) recites "means for *creating* one or more mote-addressed *content indexes of the second mote at the first mote* in response to said determining." (emphasis added). The cited text does not show or recite "*creating ... content indexes of the second mote at the first mote.*"

Applicant has reviewed the Examiner-cited portions of Mulgund and is unable to locate a recitation of clause (b) of Claim 21. Applicant further respectfully points out that the Examiner has provided no objectively verifiable evidence, or argument based on objectively verifiable evidence, as to why the text of the reference passages should be interpreted to teach clause (b) of amended Independent Claim 21.

Given that Applicant has shown, above, what Mulgund actually recites, the question thus naturally arises as to how Examiner saw Mulgund as "teaching" something related to Clause (b) of Independent Claim 21. Applicant respectfully points out that the

Applicant's Application is the only objectively verifiable examiner-cited document of record that shows or suggests what Examiner purports the reference to teach. From this and the express recitations of Mulgund as set forth, it follows that Examiner is interpreting Mulgund through the lens of Applicant's application, which is impermissible hindsight use. Thus, at present, Examiner's assertions regarding Mulgund are untenable. Under the MPEP guidelines as set forth above, the cited art of record fails to establish a prima facie case of unpatentability for at least these reasons. Accordingly, for at least the foregoing reasons, Applicant respectfully requests that Examiner hold Independent Claim 21 allowable and issue a Notice of Allowability of same.

In the alternative and/or in addition to the foregoing, as Examiner has provided no objectively verifiable evidence, nor argument based on objectively verifiable evidence, in support of Examiner assertions regarding what the technical material cited by Examiner "teaches," Applicant infers that the Examiner is relying on "personal knowledge" and/or is taking "official notice" of one or more factors to reach the factual conclusion of what the cited technical material "teaches." In view of the foregoing, if Examiner desires to maintain the rejection, in the next communication, Applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth objectively verifiable evidence in support of Examiner's currently unsupported assertions regarding what the cited technical material "teaches" and/or should be interpreted to "teach." *See, e.g.*, MPEP §2144.03(C), *If Applicant Challenges a Factual Assertion as Not Properly Officially Notices or Not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding with Adequate Evidence*, and 37 C.F.R. 1.104(d)(2).

In view of the foregoing, and under the MPEP standards as set forth above, Applicant respectfully submits that the Examiner-cited art does not establish a *prima facie* case of unpatentability of Independent Claim 21. Accordingly, for at least the foregoing reasons, Applicant respectfully asks Examiner to hold Independent Claim 21 allowable and to issue a Notice of Allowance of same.

2. Dependent Claims 22-40: Patentable for at Least Reasons of Dependency from Independent Claim 21.

Claims 22-40 depend either directly or indirectly from Independent Claim 21. "A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers." *See* 35 U.S.C. §112 paragraph 4. Consequently, Dependent Claims 22-40 are patentable for at least the reasons why Independent Claim 21 is patentable. Accordingly, Applicant respectfully requests that Examiner hold Dependent Claims 22-40 patentable for at least the foregoing reasons, and issue a Notice of Allowance on same.

F. Technical Material Cited by Examiner Mulgund et. al. (U.S. Pub. No. 2002/0161751) Does Not Show or Suggest the Text of Amended Independent Claim 45 as Presented Herein; Notice of Allowance of Same Respectfully Requested

1. Amended Independent Claim 45

Amended Independent Claim 45 recites:

> 45. A system comprising:
> a first mote;
> at least one mote-appropriate device at a second mote; and
> a mote-addressed *content index at the first mote having at least one of a sensing function, a control function, or routing/spatial information of said at least one mote-appropriate device at the second mote.* (emphasis added)

As shown in the following, the technical material cited by the Examiner does not show or suggest the text of Independent Claim 45. Accordingly, Applicant respectfully requests that Examiner allow Independent Claim 45.

a) Technical Material Cited by Examiner Does Not Show or Suggest the Text of at Least Amended Independent Claim 45.

As set forth above, Independent Claim 45 recites:

> 45. A system comprising:
> a first mote;
> at least one mote-appropriate device at a second mote; and
> [a] a mote-addressed *content index at the first mote having at least one of a sensing function, a control function, or*

routing/spatial information of said at least one mote-appropriate device at the second mote (Emphases added.)

With respect to Claim 45, Examiner has stated,

"As to claim 45, Mulgund shows
at least one mote-appropriate device comprising a sensing node (Fig. 2 and paragraph [0026]); and
a mote-addressed content index having at least a sensing function of said at least one mote-appropriate device (Fig. 3 paragraph [0037])."

See Examiner's *Office Action*, p. 22 (May 27, 2008).

(1) Examiner Citations With Regard to Clause [b] of Independent Claim 45

Applicant respectfully points out that Applicant has reviewed the portions of Mulgund identified by Examiner, and so far as Applicant can discern, Mulgund does not recite the text of clause [a] of Applicant's Independent Claim 45. Rather, the portions of Mulgund cited by Examiner recites as follows:

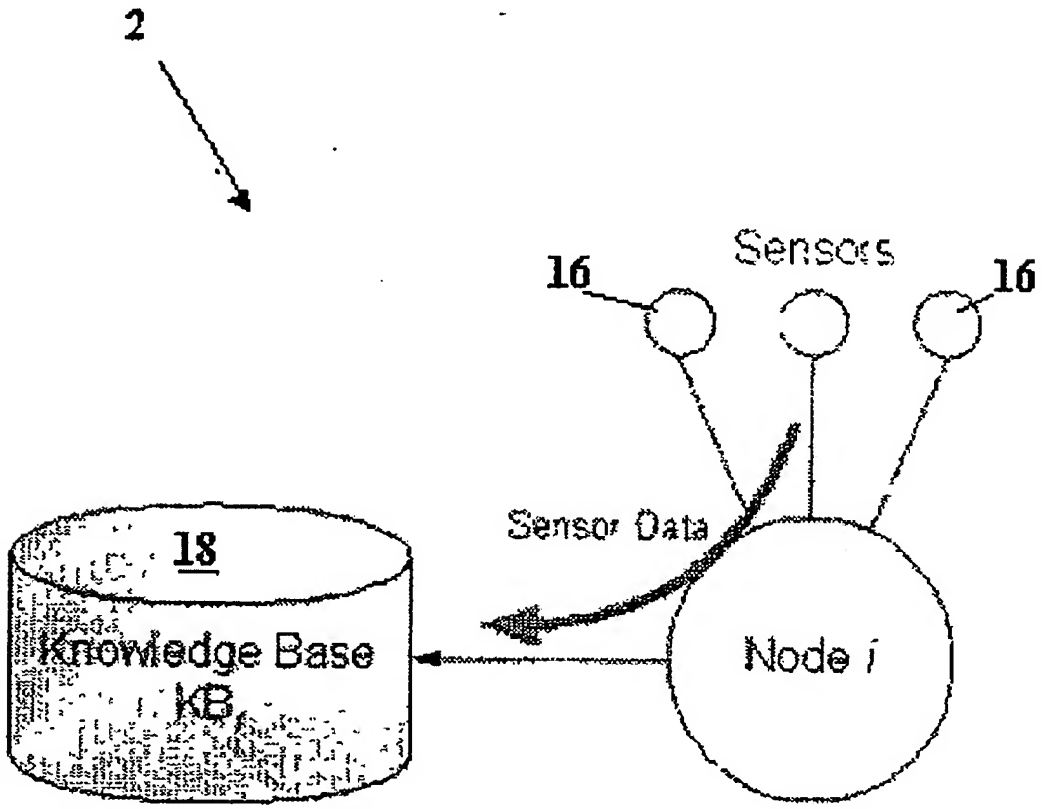
[0026] FIG. 2 illustrates the nature of each of the sensing nodes 2, which comprise computational devices (possibly ranging in complexity from small embedded platforms to a fully-fledged PCs) that have one or more sensors 16 providing high-value information connected to it. The term sensor is used here in a general sense. A sensor 16 as contemplated herein could be as simple as an instrument that measures temperature, pressure, or any such other physical quantity. It could also be a device as complex as a video camera providing continuous full-motion imagery of some area of interest. In any case, the output of each of these sensors 16 is stored locally in a well-defined knowledge base 18, but the output can be accessed from outside the network 4 through some software application programming interface (API) and hardware implementation. Each of the sensing nodes 2 is additionally in communication with one or more other sensing nodes through connecting links 3.

See *Mulgund* (paragraph 0026)

[0037] The Nodes Table 20 maintains a list of all known sensor nodes 2 in the network 4. Each node is identified by a unique Node Address, which is a primary key for the Nodes Table 20. The Nodes Table also contains a Status field, which is used to indicate whether a node is known to be active. This field is used for marking nodes that have disappeared from the network (which could later reappear). At present, it is anticipated that this Status variable will take on one of just a small set of mutually exclusive values that indicate whether or not the associated node continues to be an

active, reachable member of the network 4. Finally, the Nodes Table 20 contains a Timestamp field that indicates when the Status information was last updated. When a node disappears from the network for whatever reason, the corresponding entry in the Nodes Table 20 is not deleted; it is marked as unreachable. The reason for doing so is explained below.

See *Mulgund* (paragraph [0037])



See *Mulgund* (Fig. 2)

As can be seen from the foregoing, the Examiner-identified portions of Mulgund do *not recite* the text of clause [a] as recited in Independent Claim 45. For example, Mulgund teaches "On the LAN 8 is a database server 10 includes a network model database 12 and operates a network modeling agent (NMA) 14." [Mulgund paragraph 0020] (Emphasis added) On the other hand, clause (a) recites "a mote-addressed *content index at the first mote having at least one of a sensing function, a control function, or routing/spatial information of said at least one mote-appropriate device at the second mote.*" (emphasis added). The cited text does not show or recite "*content index at the*

first mote having at least one of a sensing function, a control function, or routing/spatial information of said at least one mote-appropriate device at the second mote."

Applicant has reviewed the Examiner-cited portions of Mulgund and is unable to locate a recitation of clause (a) of Claim 45. Applicant further respectfully points out that the Examiner has provided no objectively verifiable evidence, or argument based on objectively verifiable evidence, as to why the text of the reference passages should be interpreted to teach clause (a) of amended Independent Claim 45.

Given that Applicant has shown, above, what Mulgund actually recites, the question thus naturally arises as to how Examiner saw Mulgund as "teaching" something related to Clause (a) of Independent Claim 45. Applicant respectfully points out that the Applicant's Application is the only objectively verifiable examiner-cited document of record that shows or suggests what Examiner purports the reference to teach. From this and the express recitations of Mulgund as set forth, it follows that Examiner is interpreting Mulgund through the lens of Applicant's application, which is impermissible hindsight use. Thus, at present, Examiner's assertions regarding Mulgund are untenable. Under the MPEP guidelines as set forth above, the cited art of record fails to establish a prima facie case of unpatentability for at least these reasons. Accordingly, for at least the foregoing reasons, Applicant respectfully requests that Examiner hold Independent Claim 45 allowable and issue a Notice of Allowability of same.

In the alternative and/or in addition to the foregoing, as Examiner has provided no objectively verifiable evidence, nor argument based on objectively verifiable evidence, in support of Examiner assertions regarding what the technical material cited by Examiner "teaches," Applicant infers that the Examiner is relying on "personal knowledge" and/or is taking "official notice" of one or more factors to reach the factual conclusion of what the cited technical material "teaches." In view of the foregoing, if Examiner desires to maintain the rejection, in the next communication, Applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth objectively verifiable evidence in support of Examiner's currently unsupported assertions regarding what the cited technical material "teaches" and/or should be interpreted to "teach." *See, e.g.*, MPEP §2144.03(C), *If Applicant Challenges a Factual Assertion as Not Properly*

Officially Notices or Not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding with Adequate Evidence, and 37 C.F.R. 1.104(d)(2).

In view of the foregoing, and under the MPEP standards as set forth above, Applicant respectfully submits that the Examiner-cited art does not establish a *prima facie* case of unpatentability of Independent Claim 45. Accordingly, for at least the foregoing reasons, Applicant respectfully asks Examiner to hold Independent Claim 45 allowable and to issue a Notice of Allowance of same.

G. Technical Material Cited by Examiner Mulgund et. al. (U.S. Pub. No. 2002/0161751) and Madden ("The Design of an Acquisitional Query Processor for Sensor Networks") Do Not Show or Suggest the Text of Amended Independent Claim 41 as Presented Herein; Notice of Allowance of Same Respectfully Requested

1. Amended Independent Claim 41

Amended Independent Claim 41 recites:

> 41. A system comprising:
> a first mote;
> at least one mote-appropriate device at a second mote; and
> at least one *index creation agent resident in the first mote, said at least one index creation agent configured to create at least one of a sensing index, a control index, or a routing/spatial index associated with the second mote.* (emphasis added)

As shown in the following, the technical material cited by the Examiner does not show or suggest the text of Independent Claim 41. Accordingly, Applicant respectfully requests that Examiner allow Independent Claim 41.

a) Technical Material Cited by Examiner Does Not Show or Suggest the Text of at Least Amended Independent Claim 41.

As set forth above, Independent Claim 41 recites:

> 41. A system comprising:
> a first mote;
> at least one mote-appropriate device at a second mote; and

[a] at least one *index creation agent resident in the first mote, said at least one index creation agent configured to create at least one of a sensing index, a control index, or a routing/spatial index associated with the second mote.* (emphasis added)

With respect to Claim 41, Examiner has stated,

"As to claim 41, Mulgund shows

at least one mote-appropriate device comprising a sensing node (Fig. 2 and paragraph [0026]); and

at least one index creation agent comprising a sensor network modeling agent, said at least one index creation agent configured to create at least one of a sensing index, a control index, or a routing/spatial index (Fig. 3 and paragraph [0037]).

Mulgund also shows that each node contains some local memory or other knowledge base for recording sensor output data, which can be retrieved by interrogating the node (paragraph [0030]), which suggests that there exists some agent resident in a mote that collects data from sensors and stores it in the local knowledge base, however, the local agent per se is not explicitly shown. Madden shows an index creation agent resident in a mote comprising a TinyDB, which is a distributed query processor that runs on each of the nodes in a sensor network (section 1 Introduction, paragraph 4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund by having an index creation agent resident in the mote in order to select, join, project, and aggregate data from the sensors (section 1 Introduction, paragraph 4 in Madden).

See Examiner's *Office Action*, p. 26 (May 27, 2008).

(1) Examiner Citations With Regard to Clause [a] of Independent Claim 41

Applicant respectfully points out that Applicant has reviewed the portions of Mulgund and Madden identified by Examiner, and so far as Applicant can discern, Mulgund and Madden does not recite the text of clause [a] of Applicant's Independent Claim 41. Rather, the portions of Mulgund and Madden cited by Examiner recites as follows:

[0026] FIG. 2 illustrates the nature of each of the sensing nodes 2, which comprise computational devices (possibly ranging in complexity from small embedded platforms to a fully-fledged PCs) that have one or more sensors 16 providing high-value information connected to it. The term sensor is used here in a general sense. A sensor 16 as contemplated herein

could be as simple as an instrument that measures temperature, pressure, or any such other physical quantity. It could also be a device as complex as a video camera providing continuous full-motion imagery of some area of interest. In any case, the output of each of these sensors 16 is stored locally in a well-defined knowledge base 18, but the output can be accessed from outside the network 4 through some software application programming interface (API) and hardware implementation. Each of the sensing nodes 2 is additionally in communication with one or more other sensing nodes through connecting links 3.

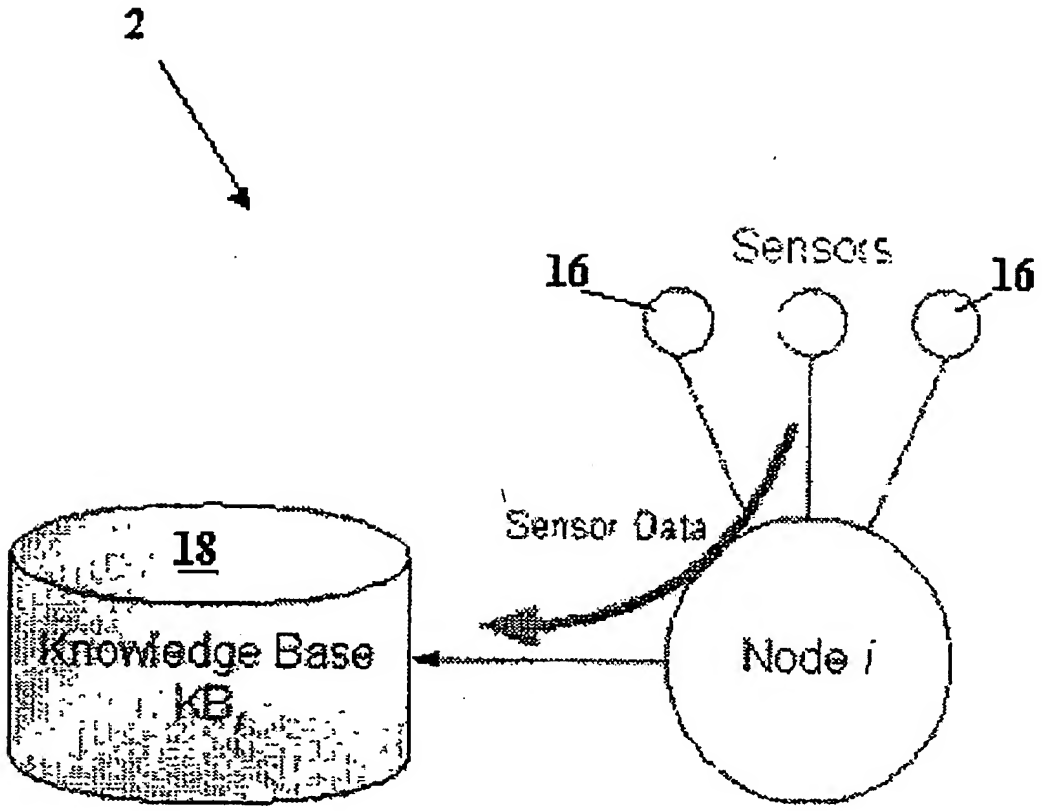
See *Mulgund* (paragraph 0026)

[0030] each node contains some local memory or other knowledge base 18 for recording sensor output data, which can be retrieved by interrogating the node;

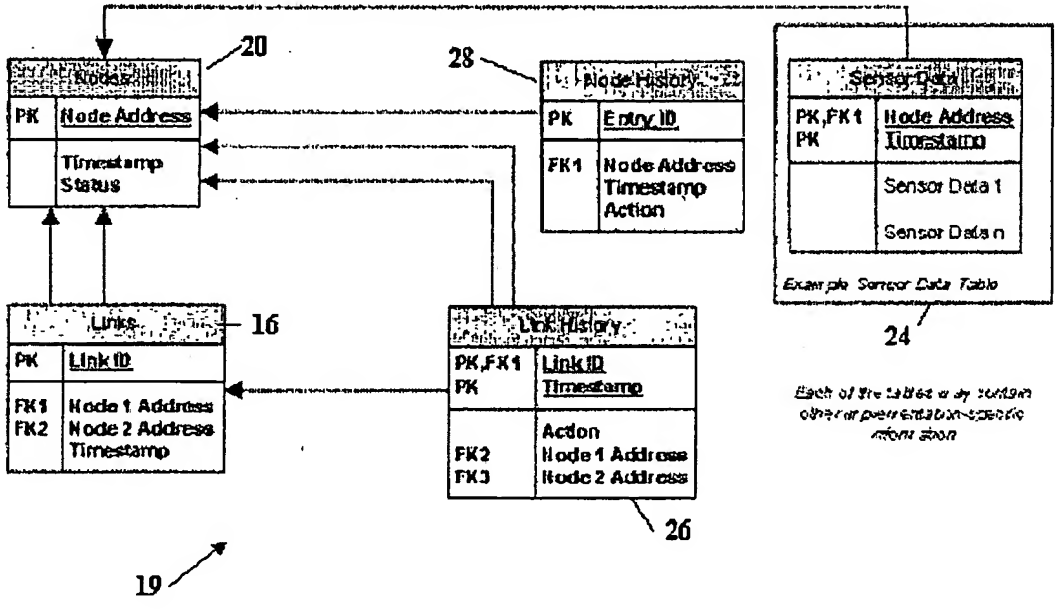
See *Mulgund* (paragraph 0030)

[0037] The Nodes Table 20 maintains a list of all known sensor nodes 2 in the network 4. Each node is identified by a unique Node Address, which is a primary key for the Nodes Table 20. The Nodes Table also contains a Status field, which is used to indicate whether a node is known to be active. This field is used for marking nodes that have disappeared from the network (which could later reappear). At present, it is anticipated that this Status variable will take on one of just a small set of mutually exclusive values that indicate whether or not the associated node continues to be an active, reachable member of the network 4. Finally, the Nodes Table 20 contains a Timestamp field that indicates when the Status information was last updated. When a node disappears from the network for whatever reason, the corresponding entry in the Nodes Table 20 is not deleted; it is marked as unreachable. The reason for doing so is explained below.

See *Mulgund* (paragraph [0037])



See *Mulgund* (Fig. 2)



See *Mulgund* (Fig. 3)

> We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica *mote* platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption *and* increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

See *Madden* (Introduction, Paragraph 4)

As can be seen from the foregoing, the Examiner-identified portions of Mulgund and Madden do *not recite* the text of clause [a] as recited in Independent Claim 41. For example, Mulgund teaches "On the LAN 8 is a database server 10 includes a network model database 12 and operates a network modeling agent (NMA) 14." [Mulgund paragraph 0020] (Emphasis added) Madden teaches "We have designed and implemented an ACQP engine, called TinyDB..." On the other hand, clause (a) recites "at least one index creation agent resident in the first mote, said at least one index creation agent *configured to create at least one of a sensing index, a control index, or a routing/spatial index associated with the second mote.*" (emphasis added). The cited text does not show or recite "*configured to create at least one of a sensing index, a control index, or a routing/spatial index associated with the second mote.*"

Applicant has reviewed the Examiner-cited portions of Mulgund and Madden and is unable to locate a recitation of clause (a) of Claim 41. Applicant further respectfully points out that the Examiner has provided no objectively verifiable evidence, or argument based on objectively verifiable evidence, as to why the text of the reference passages should be interpreted to teach clause (a) of amended Independent Claim 41.

Given that Applicant has shown, above, what Mulgund and Madden actually recites, the question thus naturally arises as to how Examiner saw Mulgund and Madden as "teaching" something related to Clause (a) of Independent Claim 41. Applicant respectfully points out that the Applicant's Application is the only objectively verifiable examiner-cited document of record that shows or suggests what Examiner purports the

reference to teach. From this and the express recitations of Mulgund and Madden as set forth, it follows that Examiner is interpreting Mulgund and Madden through the lens of Applicant's application, which is impermissible hindsight use. Thus, at present, Examiner's assertions regarding Mulgund and Madden are untenable. Under the MPEP guidelines as set forth above, the cited art of record fails to establish a prima facie case of unpatentability for at least these reasons. Accordingly, for at least the foregoing reasons, Applicant respectfully requests that Examiner hold Independent Claim 41 allowable and issue a Notice of Allowability of same.

In the alternative and/or in addition to the foregoing, as Examiner has provided no objectively verifiable evidence, nor argument based on objectively verifiable evidence, in support of Examiner assertions regarding what the technical material cited by Examiner "teaches," Applicant infers that the Examiner is relying on "personal knowledge" and/or is taking "official notice" of one or more factors to reach the factual conclusion of what the cited technical material "teaches." In view of the foregoing, if Examiner desires to maintain the rejection, in the next communication, Applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth objectively verifiable evidence in support of Examiner's currently unsupported assertions regarding what the cited technical material "teaches" and/or should be interpreted to "teach." *See, e.g.*, MPEP §2144.03(C), *If Applicant Challenges a Factual Assertion as Not Properly Officially Notices or Not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding with Adequate Evidence*, and 37 C.F.R. 1.104(d)(2).

In view of the foregoing, and under the MPEP standards as set forth above, Applicant respectfully submits that the Examiner-cited art does not establish a *prima facie* case of unpatentability of Independent Claim 41. Accordingly, for at least the foregoing reasons, Applicant respectfully asks Examiner to hold Independent Claim 41 allowable and to issue a Notice of Allowance of same.

2. Dependent Claims 42-44: Patentable for at Least Reasons of Dependency from Independent Claim 41.

Claims 42-44 depend either directly or indirectly from Independent Claim 41. "A claim in dependent form shall be construed to incorporate by reference all the

limitations of the claim to which it refers." *See* 35 U.S.C. §112 paragraph 4. Consequently, Dependent Claims 42-44 are patentable for at least the reasons why Independent Claim 41 is patentable. Accordingly, Applicant respectfully requests that Examiner hold Dependent Claims 42-44 patentable for at least the foregoing reasons, and issue a Notice of Allowance on same.

IV. REJECTION ARGUMENT: THE OFFICE ACTION ERRED IN REJECTING CLAIMS 21-40 UNDER 35 U.S.C. § 112, FIRST PARAGRAPH

The Office action, at page 14-15, recites, "Claims 21-40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement." Applicant respectfully traverses the rejections of claims 21-40.

Amended Claim 21 recites:

21. A system comprising:

means, including a storage medium, for determining at least one of a sensing function or a control function of a second mote at a first mote; and

means for creating one or more mote-addressed content indexes of the second mote at the first mote in response to said determining.

The Office action at page 15-16, paragraph 11, recites:

". . . claim 21 appears to be a single means claim, i.e., where a means recitation does not appear in combination with another recited element of means, and is, therefore subject to an undue breadth rejection under 35 U.S.C. 112, first paragraph."

Applicant has amended claim 21 to include two "means" recitations" that are performed by different functions. Therefore, application requests withdrawal of the rejection and reconsideration and allowance of claim 21.

Claims 22-40 are dependent on claim 21. For reasons analogous to those stated above, applicant requests withdrawal of the rejections and reconsideration and allowance of claims 22-40.

V. REJECTION ARGUMENT: THE OFFICE ACTION ERRED IN REJECTING CLAIMS 12-13, 32-33 AND 41-44 UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

The Examiner rejected claims 12-13, 32-33 and 41-44 under 35 USC §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Specifically the office action states "As to claims 12 and 13 (and corresponding claims 32 and 33), the step of establishing an index-creating agent at the mote in response to said step of determining is ambiguous because the order of steps is unclear.". Applicant has amended claims 12-13, and 32-33 by removing "in response to said determining." Therefore, Applicant requests withdrawal of the rejections and reconsideration and allowance of claims 12–13 and 32-33.

The office stated "As to claim 41, it is ambiguous because it is unclear if at least one mote-appropriate device is a mote or the two devices claimed (mote-appropriate device and a mote) are unrelated to each other." Applicant has amended claim 41 to clarify the alleged ambiguity. Claim 42-44 are allowable as being dependent on an allowable base claim. Applicant respectfully requests reconsideration and withdrawal of this rejection and reconsideration and allowance of claims 41-44.

VI. OBJECTION TO THE ABSTRACT OF THE DISCLOSURE

The Examiner objected to the abstract because it does not enable the USPTO and the public generally to determine quickly from a cursory inspection the nature and gist of the technical disclosure. Examiner's *Office Action*, p. 12 (May 27, 2008). Applicant has amended the Abstract to correct the informalities noted by the Examiner. Accordingly, Applicant respectfully requests reconsideration and withdrawal of these objections.

VII. OBJECTION TO THE APPLICATION

The Examiner objected to the application because it contains disclosure entirely outside the bounds of the claims. Examiner's *Office Action*, p. 12 (May 27, 2008). Applicant respectfully submits that the proper scope of the specification cannot be

determined as the prosecution of the application is still pending. Applicant maintains that the scope of the disclosure is in compliance and requests that the office provide statutes, regulations or sections of the MPEP to support the offices objection. Accordingly, Applicant respectfully requests reconsideration and withdrawal of these objections.

VIII. CLAIMS 21-40 RECITE STATUTORILY AUTHORIZED SUBJECT MATTER; NOTICE OF ALLOWANCE OF SAME RESPECTFULLY REQUESTED

A. Independent Claim 21 Recites Statutorily Authorized Subject Matter; 35 U.S.C. § 101 Non-statutory subject matter rejection is unfounded; Notice of Allowance of Same Respectfully Requested

Amended Independent Claim 21 recites as follows:

> 21. A system comprising:
>
> means, *including a storage medium,* for determining at least one of a sensing function or a control function of a second mote at a first mote; and
>
> means for creating one or more mote-addressed content indexes of the second mote at the first mote in response to said determining. (emphasis added)

With respect to Claim 21, the Examiner has stated:

> "Claims 21-40 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claim 21 incorporates means-plus-function language limitations reciting a
>
> function to be performed rather than definite structure or materials for performing that function. As to claim 21, limitations: "means for determining" and "means for creating" are interpreted to invoke 35 USC 112, sixth paragraph.
>
> The current specification must be reviewed to assist in identifying the corresponding structure that performs the claimed function. The specification shows that determining at least one of a sensing function or a control function at a mote and creating one or more mote-addressed content indexes in response to said determining is performed by an index creation agent (202) (bottom of page 9, page 10). Therefore, means for determining are interpreted to be an index creation agent (202), and means for creating are also interpreted to be an index creation agent (202).
>
> Since the index creation agent is a computer program, as evidenced by specification at page 8 last paragraph, a system of a computer software per se is not in one of the statutory categories.

> The use of the word "system" does not inherently mean that the claim is directed to a machine. Only if at least one of the claimed elements of the system is a physical part of a device can the system as claimed constitute part of a device or a combination of devices to be a machine within the meaning of 35 U.S.C. 101.
>
> Evidence is present in the specification that suggests to one of ordinary skill in
> the art that all claimed elements of the system (means for determining and means for creating) may be reasonably implemented as software programs per se, therefore the claim is rejected as a system of software per se, failing to fall within a statutory category of invention.
>
> Claim 22 fails to introduce at least one physical part that would make the claimed system statutory, therefore this claim is rejected for the same reasons as claim 21.
>
> As to claims 23-40, additional means-plus-function language does not introduce any tangible elements by further limiting either one of means for determining or means for creating which were identified above as software elements per se. Therefore, additional means fail to render a system of claim 21 statutory under 35 U.S.C. 101."

See Examiner's *Office Action*, page 13-14 (April 29, 2008).

Applicant respectfully traverses the rejection. Claim 21 states in relevant part "means, including a storage medium, for determining at least one of a sensing function or a control function of a second mote at a first mote; and means for creating one or more mote-addressed content indexes of the second mote at the first mote in response to said determining." Examples of a storage medium and a mote are provided throughout the specification.

Applicant further notes that in the case of *In re Nuijten, 500 F.3rd 1346 (Fed. Cir. 2007)*, the Federal Circuit stated:

> The issue before the court is whether or not a signal [*simpliciter*] is patentable subject matter.
>
> ...
>
> The above-described procedure is most naturally expressed as a series of steps for adding a low-distortion watermark to a signal, and indeed Nuijten has already obtained allowance of ten claims (Claims 1-10) directed to such a process.... Nuijten's Claims 11-13, also allowed by the PTO, are directed to "[a]n arrangement for embedding supplemental data in a signal," including "encoder means for encoding the signal" and other structural features that carry out the above process. **Finally, Nuijten's allowed Claim 15** is **directed to "[a] storage medium having** stored thereon **a signal with embedded supplemental data**," where the stored signal has essentially the encoding properties described above. Thus, **Nuijten has been allowed claims** to the **process** he invented, a **device that performs that process**, and a **storage medium holding the resulting signals**.

...

The **claims** whose disallowance **Nuijten appeals** **are not** traditional step-by-step **process claims**, **nor** are they directed to any **apparatus** for generating, receiving, processing, or **storing the signals**. As mentioned above, **such claims have been allowed**.

In re Nuijten, 500 F.3rd 1346 (Fed. Cir. 2007) (emphasis added).

At oral argument, the PTO invoked printed matter cases in the context of **why Nuijten's claim 15, to "a storage medium having stored thereon" a signal, was allowable even though (according to the PTO) claim 14, to the signal *simpliciter*, was not**....

From this, the **PTO** apparently **takes the position that functional but intangible software, data structures, signals, and the like are patentable under *Lowry* if they are encoded on a tangible medium**, **but unpatentable** (as failing a tangibility requirement to be "manufactures") **if the medium is not referenced in the claims**.

In re Nuijten, 500 F.3rd 1346 (Fed. Cir. 2007) (Linn Dissent)

Therefore, since "a computer-readable *storage* medium bearing the program instructions" **IS** recited in Claim 21, Applicant respectfully requests that Examiner hold Claim 21 patentable for at least the reasons set forth herein. Claim 22-40 depend from Claim 21, and for at least this reason, are also patentable.

Therefore, Applicant respectfully submits that claims 21-40 satisfy 35 USC §101, and recite a useful, concrete, and tangible result, and respectfully requests reconsideration and withdrawal of these rejections.

IX. CONCLUSION

Applicant may have during the course of prosecution cancelled and/or amended one or more claims. Applicant notes that any such cancellations and/or amendments will have transpired (i) prior to issuance and (ii) in the context of the rules that govern claim interpretation during prosecution before the United States Patent and Trademark Office (USPTO). Applicant notes that the rules that govern claim interpretation during prosecution form a radically different context than the rules that govern claim interpretation subsequent to a patent issuing. Accordingly, Applicant respectfully submits that any cancellations and/or amendments during the course of prosecution should be

held to be tangential to and/or unrelated to patentability in the event that such cancellations and/or amendments are viewed in a post-issuance context under post-issuance claim interpretation rules.

Insofar as that the Applicant may have during the course of prosecution cancelled/amended/argued claims sufficient to obtain a Notice of Allowability of all claims pending, Applicant may not have during the course of prosecution explicitly addressed all rejections and/or statements in Examiner's Office Actions. The fact that rejections and/or statements may not be explicitly addressed during the course of prosecution should NOT be taken as an admission of any sort, and Applicant hereby reserves any and all rights to contest such rejections and/or statements at a later time. Specifically, no waiver (legal, factual, or otherwise), implicit or explicit, is hereby intended (e.g., with respect to any facts of which Examiner took Official Notice, and/or for which Examiner has supplied no objective showing, Applicant hereby contests those facts and requests express documentary proof of such facts at such time at which such facts may become relevant). For example, although not expressly set forth during the course of prosecution, Applicant continues to assert all points of (e.g. caused by, resulting from, responsive to, etc.) any previous Office Action, and no waiver (legal, factual, or otherwise), implicit or explicit, is hereby intended. Specifically, insofar as that Applicant does not consider the cancelled/unamended claims to be unpatentable, Applicant hereby gives notice that it may intend to file and/or has filed a continuing application in order prosecute such cancelled/unamended claims.

With respect to any cancelled claims, such cancelled claims were and continue to be a part of the original and/or present patent application(s). Applicant hereby reserves all rights to present any cancelled claim or claims for examination at a later time in this or another application. Applicant hereby gives public notice that any cancelled claims are still to be considered as present in all related patent application(s) (e.g. the original and/or present patent application) for all appropriate purposes (e.g., written description and/or enablement). Applicant does NOT intend to dedicate the subject matter of any cancelled claims to the public.

The Examiner is invited to contact Dale Barr (360) 627-7147 or Dale R. Cook at (425) 467-2260 with any issues that may advance prosecution of the application on the merits.

Respectfully submitted,

__/Dale C. Barr, Reg. No. 40,498/_
Dale C. Barr
Registration No. 40,498